CLAIMS

What is claimed is:

1. A method for producing a lattice fin for use on a fluid-born body, comprising the steps of:

providing a plurality of mandrels, the mandrels having cross sections configured to provide individual cells of the lattice fin;

assembling the plurality of mandrels into a lattice fin log, at least every other mandrel covered with at least a single layer of a fiber reinforced composite material;

curing the lattice fin log at a temperature and for a duration sufficient to allow a matrix precursor material to cure to form a solid matrix within the fiber reinforced composite material; and

slicing the lattice fin log into individual lattice fins.

2. The method of claim 1, wherein in the step of assembling the lattice fin log, the composite material comprises a fibrous reinforcement pre-impregnated with the matrix precursor material in a partially cured state.

3. The method of claim 1, wherein the step of assembling the lattice fin log further comprises infusing a dry fibrous reinforcement with the matrix precursor material to provide the fiber reinforced composite material.

4. The method of claim 1, wherein the step of assembling the lattice fin log further comprises filament winding reinforcing fibers onto the mandrels.

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5. The method of claim 1, wherein the step of assembling the lattice fin log further comprises braiding reinforcing fibers onto the mandrels.

6. The method of claim 1, wherein the step of assembling the lattice fin log further comprises wrapping broadgoods onto the mandrels.

7. The method of claim 1, wherein the step of assembling the lattice fin log further comprises inserting a layer of broadgoods between rows of mandrels.

8. The method of claim 1, wherein the fiber reinforced composite material comprises a carbon fiber fabric and an epoxy resin matrix.

9. The method of claim 1, wherein the step of assembling the lattice fin log further comprises covering each mandrel with a single layer of the fiber reinforced composite material.

10. The method of claim 1, where the step of assembling the lattice fin log further comprises covering at least a portion of the mandrels with multiple layers of the fiber reinforced composite material.

11. The method of claim 1, further comprising overwrapping the lattice fin log with an outer layer of a fiber reinforced composite material to form an outer frame.

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12. The method of claim 1, further comprising forming an outer frame on the lattice fin log after the step of curing the lattice fin log.

13. The method of claim 12, wherein the outer frame is formed of a fiber reinforced composite material.

14. The method of claim 12, wherein the outer frame is formed of a metal.

15. The method of claim 1, further comprising attaching a base to each lattice fin, the base configured for attachment to the fluid-born body.

16. The method of claim 15, wherein the base is configured for pivoting attachment to the fluid-born body.

17. The method of claim 1, wherein the step of assembling the lattice fin log further comprises forming a base configuration integrally with the lattice fin log, the base configuration defining a base for the individual lattice fins.

18. The method of claim 1, further comprising coating each mandrel with a release agent prior to assembling the mandrels into the lattice fin log.

19. The method of claim 1, further comprising placing the lattice fin log in a tooling assembly prior to the curing step.

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20. The method of claim 19, wherein the tooling assembly comprises a mold assembly having a mold cavity configured to receive the lattice fin log.

21. The method of claim 19, further comprising heating the tooling assembly to cure the lattice fin log.

22. The method of claim 19, further comprising placing the tooling assembly in a curing press or a curing oven to cure the lattice fin log.

23. The method of claim 19, further comprising placing an alignment fixture assembly on each end of the mandrels of the lattice fin log, the alignment fixture assemblies configured to maintain the mandrels in alignment during the curing step.

24. The method of claim 23, wherein the alignment fixture assemblies comprise alignment buttons on each end of each mandrel, each alignment button configured to abut adjacent alignment buttons.

25. The method of claim 19, further comprising placing an alignment fixture assembly on each end of the mandrels of the lattice fin log, the alignment fixture assemblies configured to restrain rotation of the mandrels during the curing step.

26. The method of claim 25, wherein the alignment fixture assemblies comprise alignment buttons on each end of each mandrel, each alignment button configured to abut adjacent alignment buttons.

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27. The method of claim 1, further comprising curing the lattice fin log in a vacuum bag assembly.

28. The method of claim 27, further comprising infusing the fiber reinforced composite material with the matrix precursor material through the vacuum bag prior to the curing step.

29. The method of claim 27, further comprising placing the vacuum bag in an autoclave.

30. The method of claim 1, wherein each mandrel comprises an extrusion of metal or plastic.

31. The method of claim 30, wherein the metal comprises aluminum.

32. The method of claim 30, wherein a portion of the mandrels have a square cross section and a further portion of the mandrels have a triangular cross section.

33. The method of claim 30, wherein all of the mandrels are extruded with the square cross-section, and the further portion of the mandrels are machined to have the triangular cross section.

34. The method of claim 1, wherein the mandrels comprise a dissolvable material.

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35. The method of claim 1, further comprising removing the mandrels from the lattice fin log prior to slicing the lattice fin log into individual lattice fins.

36. The method of claim 1, further comprising removing the mandrels from the individual lattice fins.

37. The method of claim 1, wherein in the slicing step, the lattice fins are sliced transversely to a longitudinal axis of the lattice fin log.

38. The method of claim 1, wherein in the slicing step, the lattice fins are sliced with a planar cut.

39. The method of claim 1, wherein in the slicing step, the lattice fins are sliced with a contoured configuration.

40. A lattice fin for use on a fluid-born body formed by the method of claim 1.

41. A method for producing a lattice fin for use on a fluid-born body, comprising the steps of:

forming an interior cell structure comprising cell walls formed of metal strips arranged to define cells, the metal strips attached to adjoining metal strips to form cell wall joints;

forming an outer frame around the interior cell structure; and

forming a base on the outer frame, the base configured for pivoting attachment to the fluid-born body.

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42. The method of claim 41, wherein the step of forming the interior cell structure further comprises:

providing a plurality of elongated metal strips having a length and a width;

forming a plurality of slits extending at intervals along the length of the elongated metal strips for a distance of half way along the width, the strips configured to engage with slits of an interlocking strip;

sliding strips together with pairs of slits aligned at the cell wall joints; and

fastening the strips together at the cell wall joints.

43. The method of claim 42, wherein the slits are provided to extend from a same elongated side of each strip.

44. The method of claim 42, wherein the slits are provided to extend from both elongated sides of each strip.

45. The method of claim 41, wherein the step of forming the interior cell structure further comprises:

providing a plurality of elongated metal strips having a length and a width;

bending the elongated metal strips in a stair step fashion to provide bends;

attaching the elongated metal strips at the bends to form the interior cell structure.

46. The method of claim 41, wherein the step of forming the interior cell structure further comprises:

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providing a plurality of elongated metal strips having a length and a width;

attaching adjacent metal strips together on opposing faces at alternating locations to form the cell wall joints; and

expanding the metal strips to provide the interior cell wall structure.

47. The method of claim 41, wherein the step of forming the interior cell structure further comprises:

providing a plurality of metal tubes, each tube defining a cell;

stacking the metal tubes in an array to define the cell structure;

attaching the metal tubes at points of contact between adjacent tubes to form the cell wall joints; and

slicing the attached metal tubes transversely to the length of the tubes to provide a plurality of slices, a slice defining the interior cell structure.

48. The method of claim 41, wherein the interior cell structure is formed of stainless steel.

49. The method of claim 41, further comprising providing an aerodynamic shape to the cell walls.

50. The method of claim 41, further comprising forming a bevel along at least one edge of the strips.

51. The method of claim 41, further comprising forming a bevel along both edges of the strips.

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52. The method of claim 41, wherein the outer frame is formed from a metal strip attached to a perimeter of the interior cell structure.

53. The method of claim 41, wherein the outer frame is formed from a composite material attached to a perimeter of the interior cell structure.

54. A lattice fin for use on a fluid-born body formed by the method of claim 41.

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